DOCUMENT-IDENTIFIER: US 20020177243 A1

TITLE: Semiconductor device having a ferroelectric capacitor and a fabrication process thereof

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[0024] Meanwhile, it is known that the **PZT** or PLZT film constituting the ferroelectric capacitor insulation film 16 of FIG. 1 shows a **columnar** microstructure and that the value of the spontaneous polarization 2Pr is maximized when the crystal **grains** therein are oriented in the <111> direction.

DOCUMENT-IDENTIFIER: US 20020158278 A1

TITLE: Ferroelectric semiconductor memory device and a fabrication process
thereof

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[0081] As represented in FIG. 4, the projections and depressions that can be
seen on the surface of the **PZT** film 34 in the SEM images of FIGS. 3A-3D
correspond to the **columnar** crystal **grains of PZT** grown in the **PZT** film 34 as a
result of the crystallization of the **PZT** film 34.

DOCUMENT-IDENTIFIER: US 20020158278 A1

TITLE: Ferroelectric semiconductor memory device and a fabrication process
thereof

---------- KWIC ---------

[0081] As represented in FIG. 4, the projections and depressions that can be
seen on the surface of the **PZT** film 34 in the SEM images of FIGS. 3A-3D
correspond to the **columnar** crystal **grains of PZT** grown in the **PZT** film 34 as a
result of the crystallization of the **PZT** film 34.

DOCUMENT-IDENTIFIER: US 20020030723 A1

TITLE: Piezoelectric thin film component, inkjet type recording head and
inkjet printer using this [piezoelectric thin film component], and method of
manufacturing piezoelectric thin film component

---------- KWIC ---------

[0054] The **PZT** film is comprised of a polycrystalline substance, and the grain
boundaries of the crystal **grains** exist roughly in a vertical direction with
respect to the planes of the top and bottom electrodes 14 and 16, that is, in
the film thickness direction of the piezoelectric thin film, as FIG. 14 and
FIG. 15 show. In other words, the crystal **grains of PZT are in a columnar**
structure, as described later.

[0100] If **PZT** is grown using titanium crystals as the nucleus, crystal **grains**
**of the PZT** grow such that [one grain] is formed on a plurality of adjacent
platinum crystals of the bottom electrode. Normally manufacturing is easy with
Pt, which has a stable 111 orientation, and if titanium seed crystals are
formed on crystal grain boundaries which are less influenced by the orientation
of platinum, it is possible to form **PZT** crystals to be **columnar** crystals with a
(100) and (001) orientation, which are not influenced by the crystal
orientation of platinum. Since a crystal grain of the **PZT** is formed on a
plurality of [crystals] of the bottom electrode, an improvement of adhesion
with the bottom electrode is expected.